NSCAT Improves the Estimation of the Hydrologic Balance in both Tropical and Midlatitude Cyclones

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Over the ocean, ground-based measurement of precipitation (P) is extremely spotty and quite unreliable, and there is practically no direct measurement of evaporation (E). In the past, large scale fresh water flux into the ocean F=P-E was estimated using conservation principal. F is equated to the horizontal divergence of the vertically integrated water vapor transport, the computation of which requires measurements of vertical profiles of wind vector and humidity in the atmosphere. The NASA scatterometer (NSCAT), designed to measure ocean surface wind vectors at 25 km resolution, was launched on the Japanese Satellite ADEOS-1. On September 15, the first day of routine operation, NSCAT observes Typhoon Tom south of Japan and a midlatitude cyclone east of Japan. Data from the Special Sensor Microwave Imager (SSMI) show heavy precipitation in the core of the typhoon and in the frontal areas of the midlatitude storm. Computation of F, using wind and humidity profiles of the reanalysis of model results from the National Center of Environment Prediction (NCEP) fails to identify the typhoon and misses the frontal structure of the mid-latitude cyclone. It is apparent that the coarse spatial resolution of the NCEP products is insufficient to resolve small-scale weather systems. By replacing the first level wind of NCEP data with NSCAT winds, the resultant F pattern is in better agreement with the SSMI rain patterns, and clearly reveals the spiral structures of the two storm. Typhoon Tom later merged with the midlatitude storm and NSCAT monitored the extratropical transition. The study demonstrates that spaceborne scatterometers improve the estimation of the hydrologic balances in storms. The influence of NSCAT winds is not confined to the surface, but will be felt throughout the atmospheric column, because of mass conservation.